

VCSEL WITH ION-IMPLANTED CURRENT-CONFINEMENT STRUCTURE**ABSTRACT**

A VCSEL having current confinement has a substrate, a semiconductor active region, and a bottom mirror disposed between the substrate and the active region. A first top spacer layer is epitaxially grown on the active region, the first top spacer layer comprising a current-spreading buffer layer disposed on the active region, a current-confinement layer disposed on the
5 buffer layer, and a current-spreading platform layer disposed on the current-confinement layer, wherein the combined thickness of the platform and current-confinement layers is less than the thickness of the buffer layer. A current-confinement structure having an annular region of enhanced resistivity and a central aperture of comparatively lower resistivity is formed in the current-confinement layer using ion implantation. Subsequently, epitaxial regrowth is performed
10 to form a second top spacer layer on the platform layer, said second top spacer layer comprising a top current-spreading layer. The resulting current-confinement structure is the result of a shallower ion implantation and thus has more precise dimensions and can be closer to the active region.